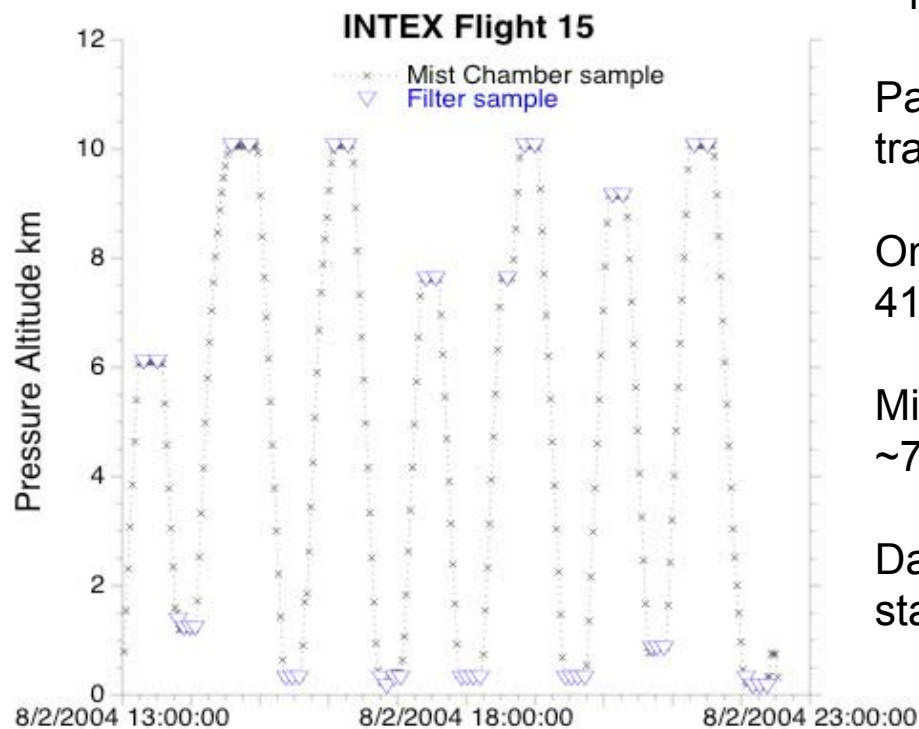


UNH Soluble Acidic Gases and Aerosol (SAGA) during INTEX Phase A

Jack E. Dibb, Eric Scheuer, and
Robert W. Talbot

With Thanks to the INTEX
Science Team





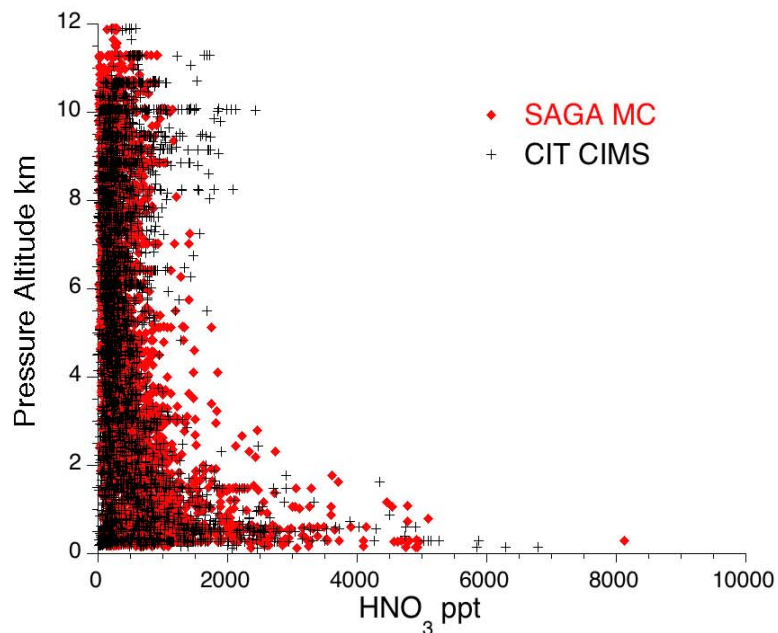
HNO_3 and fine $\text{SO}_4^{=}$ in MC every
~106 seconds.

Paired filter samples (ions and radionuclide
tracers) on level legs.

On this example flight 323 MC samples,
41 filter samples.

Mission totals: ~ 5000 MC samples,
~700 filters.

Data “final” except for ^{210}Pb (analysis will
start soon).



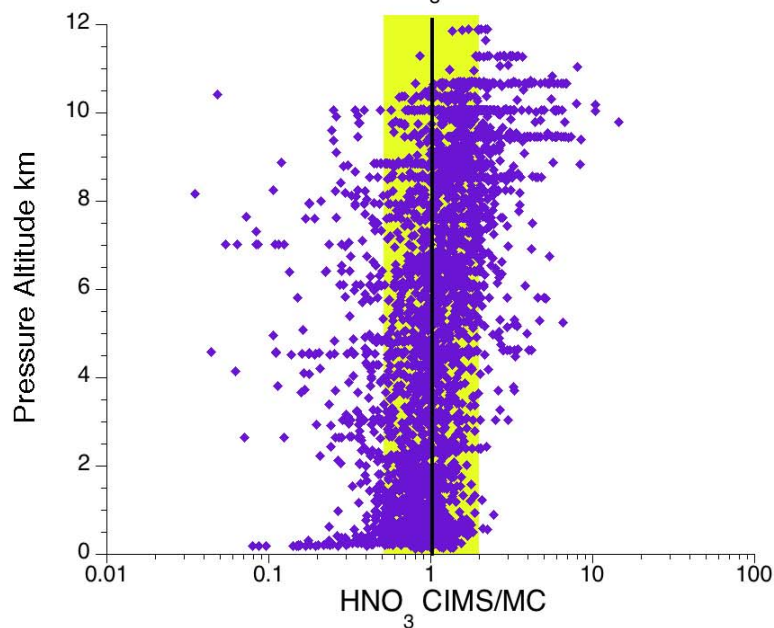
Two different measurements of HNO_3 on the DC-8.

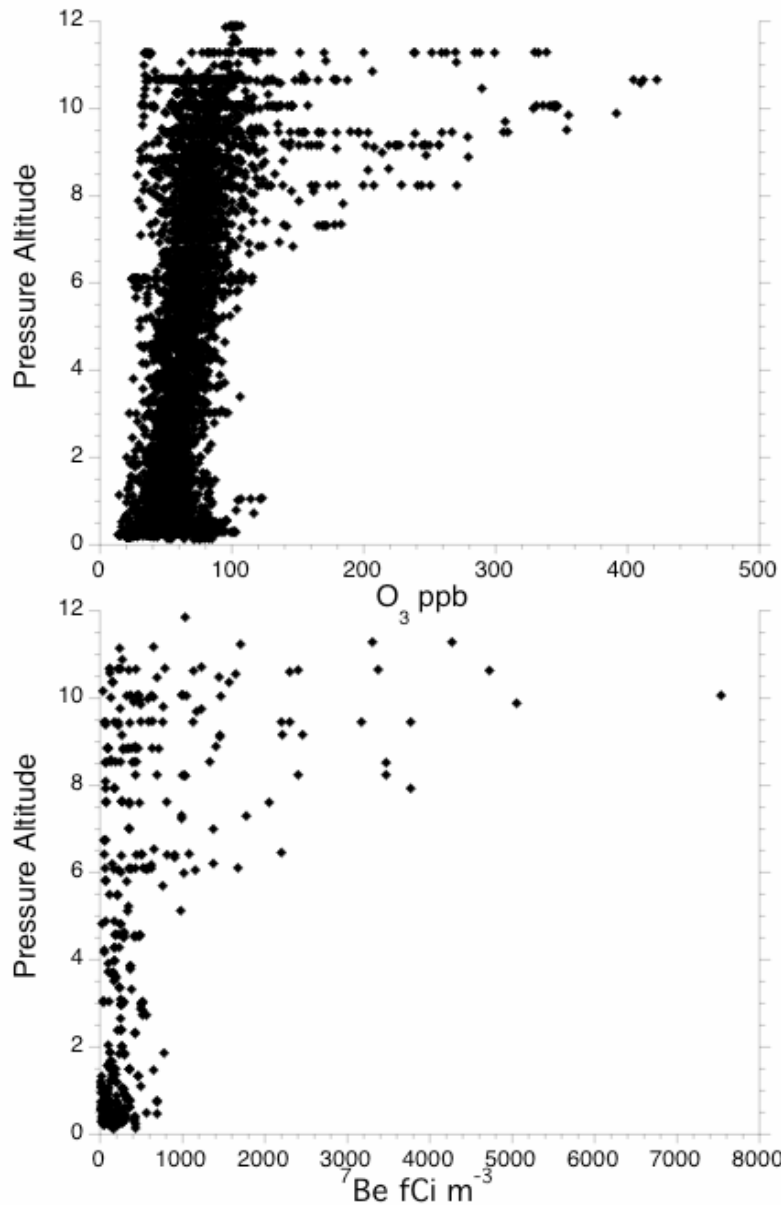
Agreement between the SAGA MC and CIT CIMS is reasonable at first glance.

For the 3156 overlapping samples in the MC merge the mean value of the ratio CIMS/MC was 1.30 ± 0.98 , with median of 1.07.

However, there is substantial scatter, and an apparent trend in the ratio with altitude.

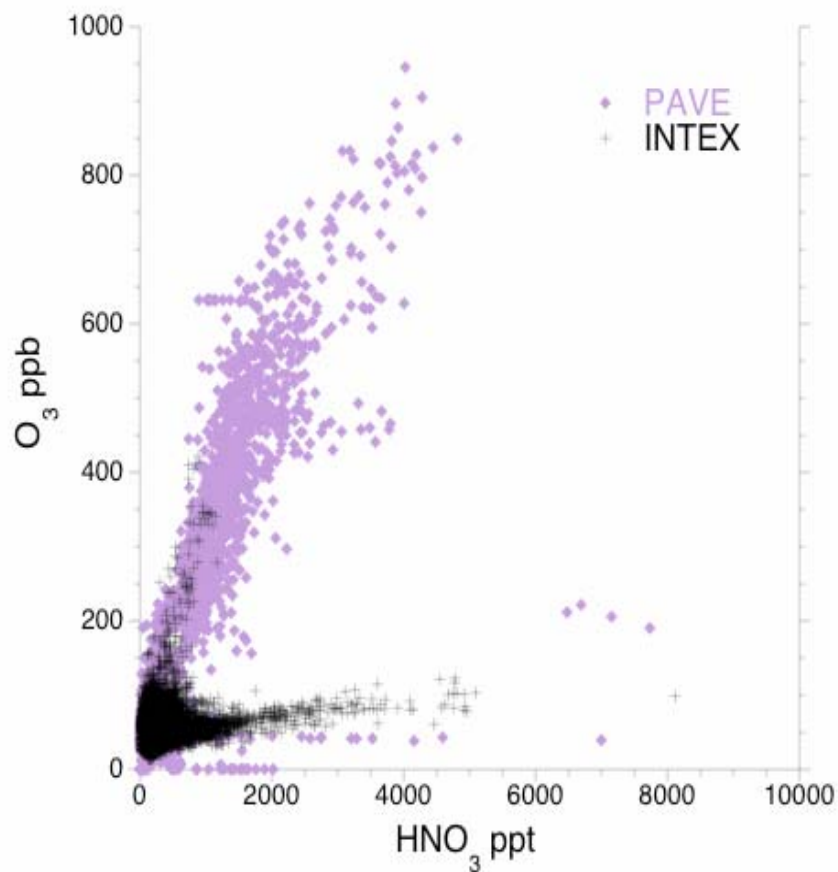
There is a poster with more details, see John Crounse if you are interested but missed it last night.





In the field we all noted that O₃ was pretty low in the troposphere. High O₃ in stratospheric parcels was encountered, but did not seem that frequent or important as a source of tropospheric O₃.

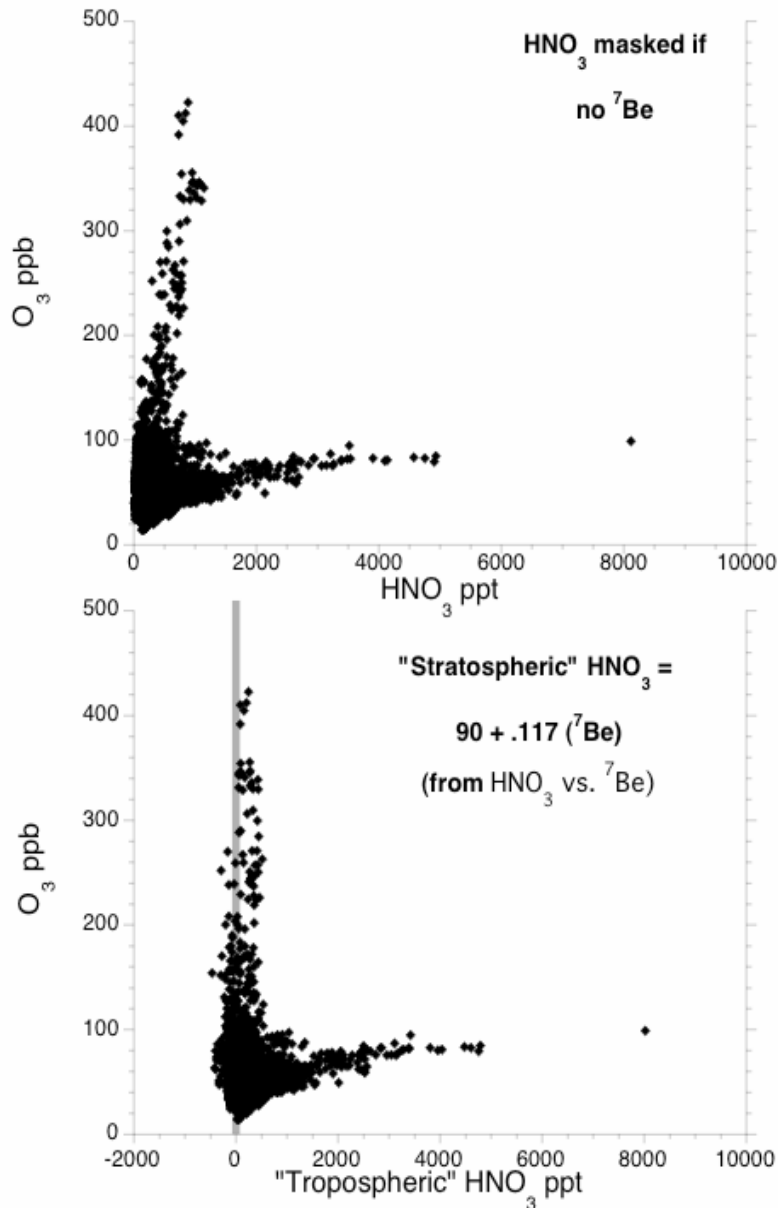
Altitude distributions of O₃ and ⁷Be suggest strat influence may have been significant above 6-7 km.



Relationship between HNO_3 and O_3 clearly indicates distinct “strat” and “trop” populations in the INTEX data set.

The INTEX “strat” relationship is very similar to what we found on PAVE in Jan-Feb, 2005.

Also, measurements by Fahey from the WB-57 during AVE Houston (Oct, 2004) show the same trend.

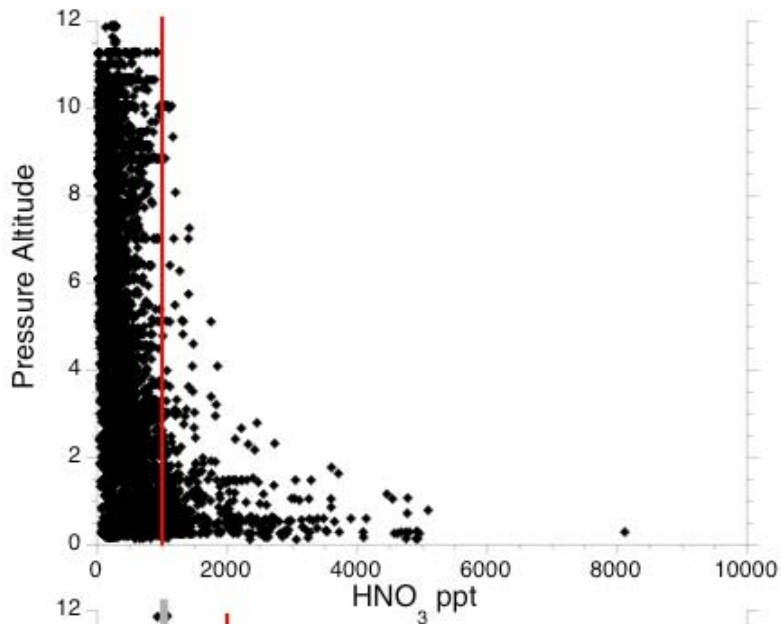


Can the stratospheric influence be filtered out?

Choosing thresholds of O_3 or ^7Be problematic near the vertex of the two "arms" of the distribution.

The correlation between HNO_3 and ^7Be in the clearly "strat" influenced airmasses can be used to estimate "strat" HNO_3 , hence "trop" HNO_3 as the residual.

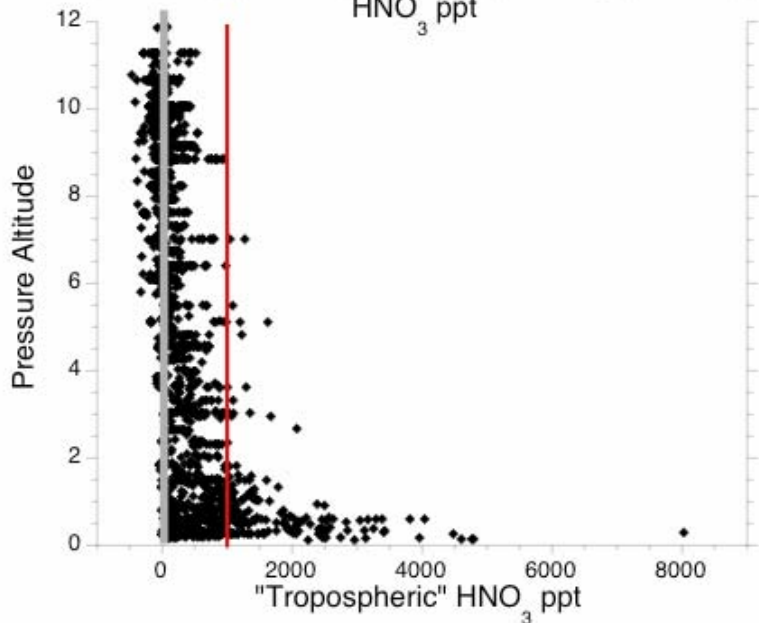
Encouraging, but, we only have ^7Be on level legs!



Estimated “trop” HNO₃ nearly an order of magnitude lower than total in UT/LS, and 2.5 times lower in mid troposphere.

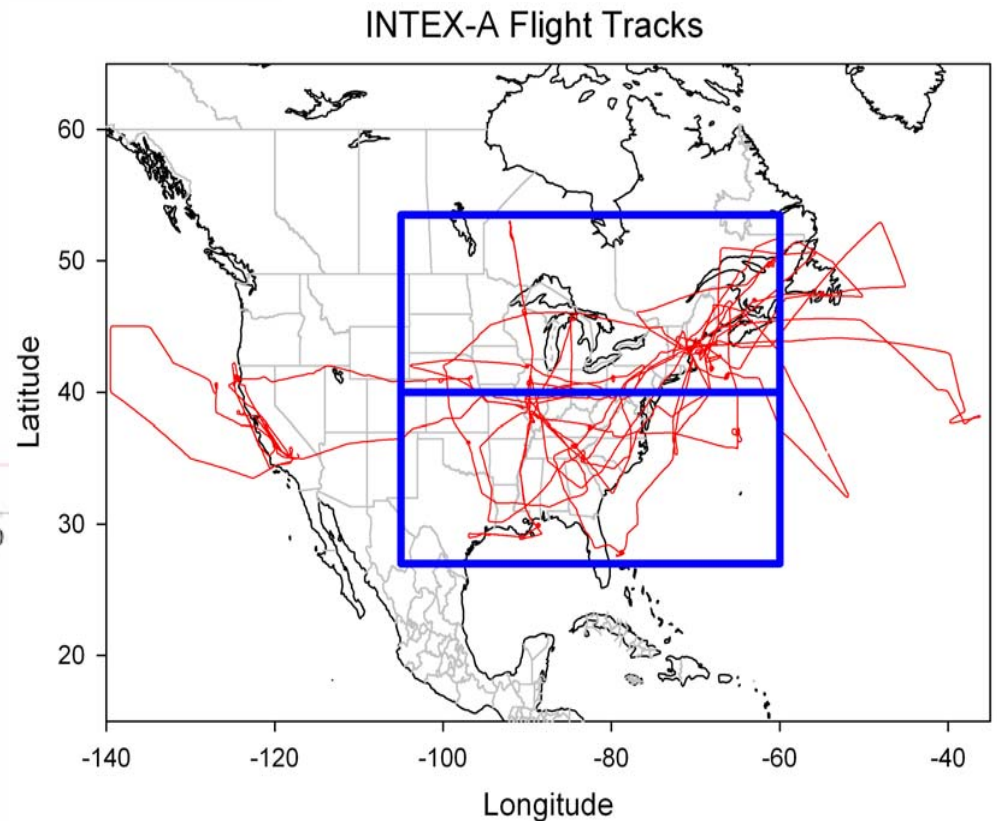
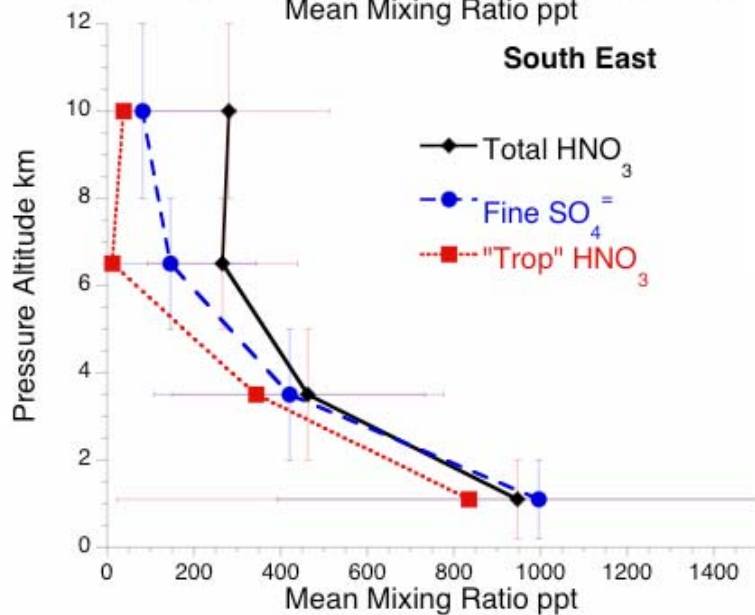
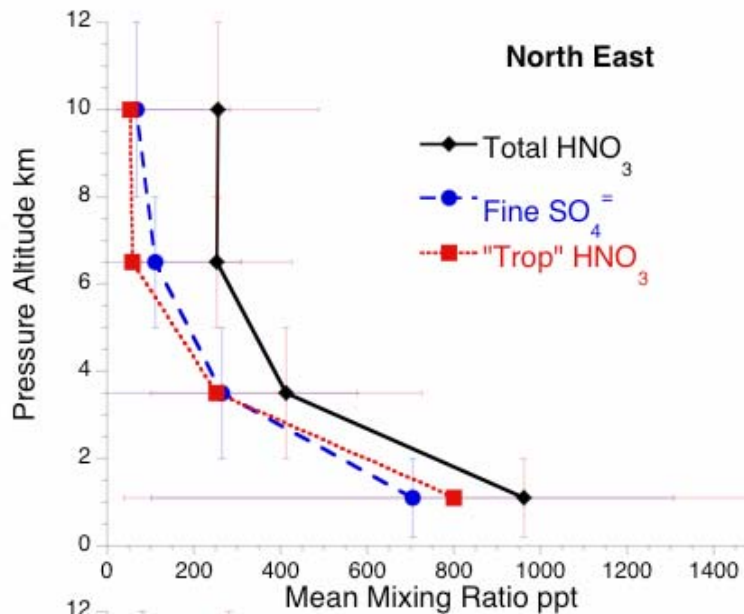
Above 8 km mean = 232 ppt
(1464 samples)

5-8 km mean = 267 ppt
(975 samples)



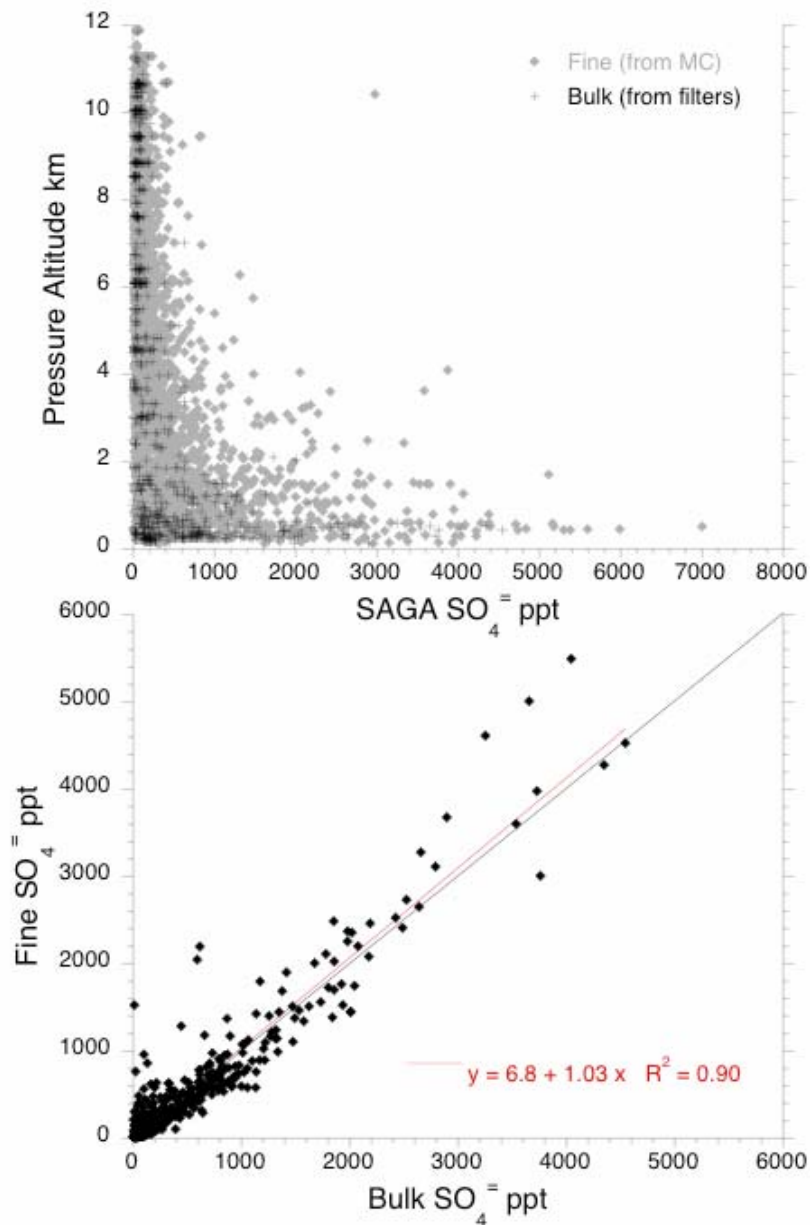
Above 8 km mean = 25 ppt
(825 samples)

5-8 km mean = 101 ppt
(393 samples)



Suggested (during mission and at AGU) that enhanced HNO_3 in UT could reflect convection.

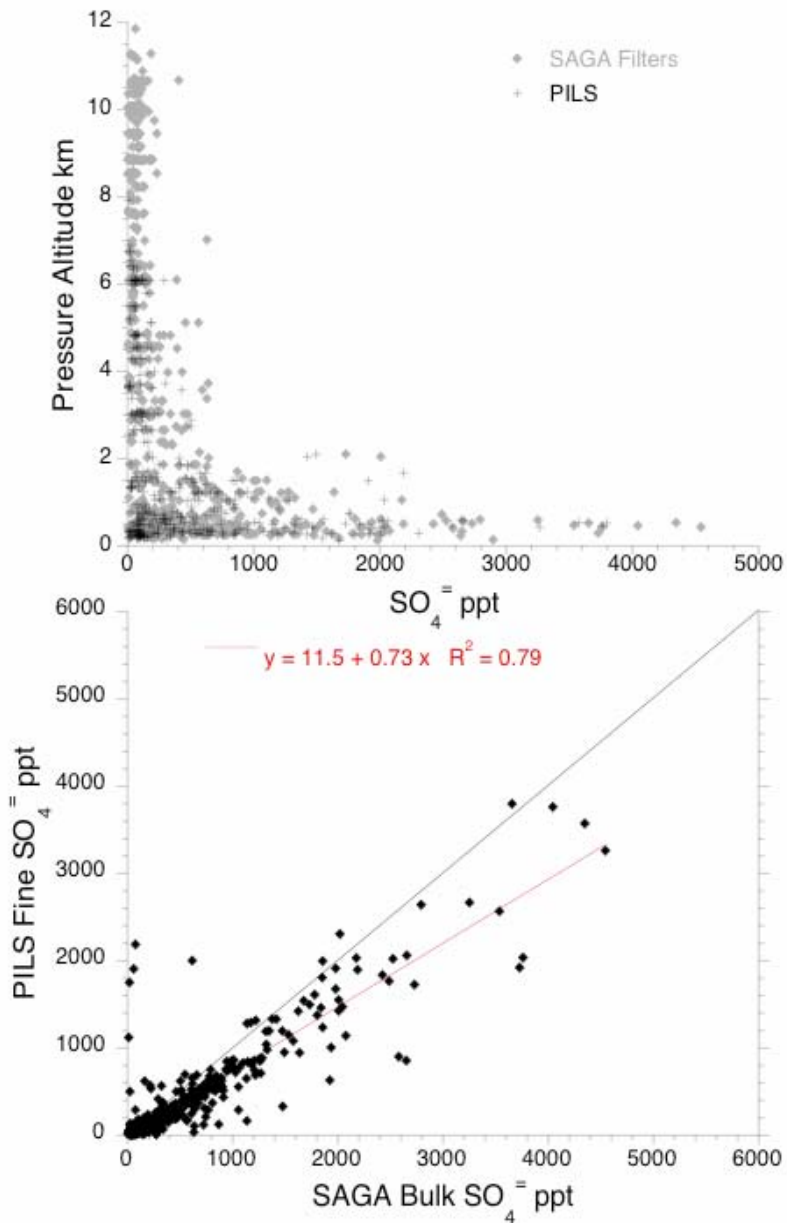
May still be true, remember the ^7Be filter excludes many samples taken on ascents/descents.



Three different measurements of SO_4^- in aerosol on the DC-8.

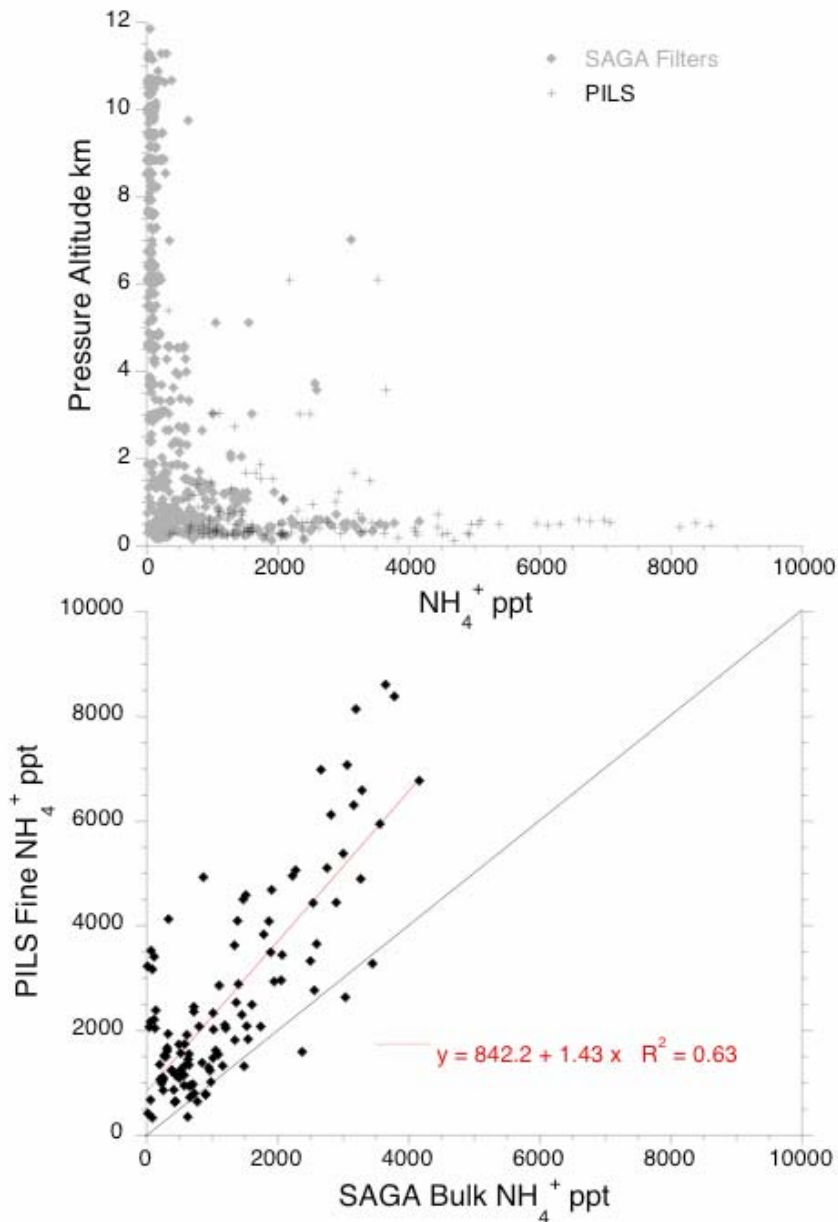
The SAGA MC data on fine (< 2.5 micron) SO_4^- agrees closely with the SAGA filter-based data.

Differences between the two techniques should generally fall below the 1:1 line if there is any coarse SO_4^- , so the agreement is a little “too good”.



SAGA bulk SO₄⁼ was generally > PILS sub-micron SO₄⁼.

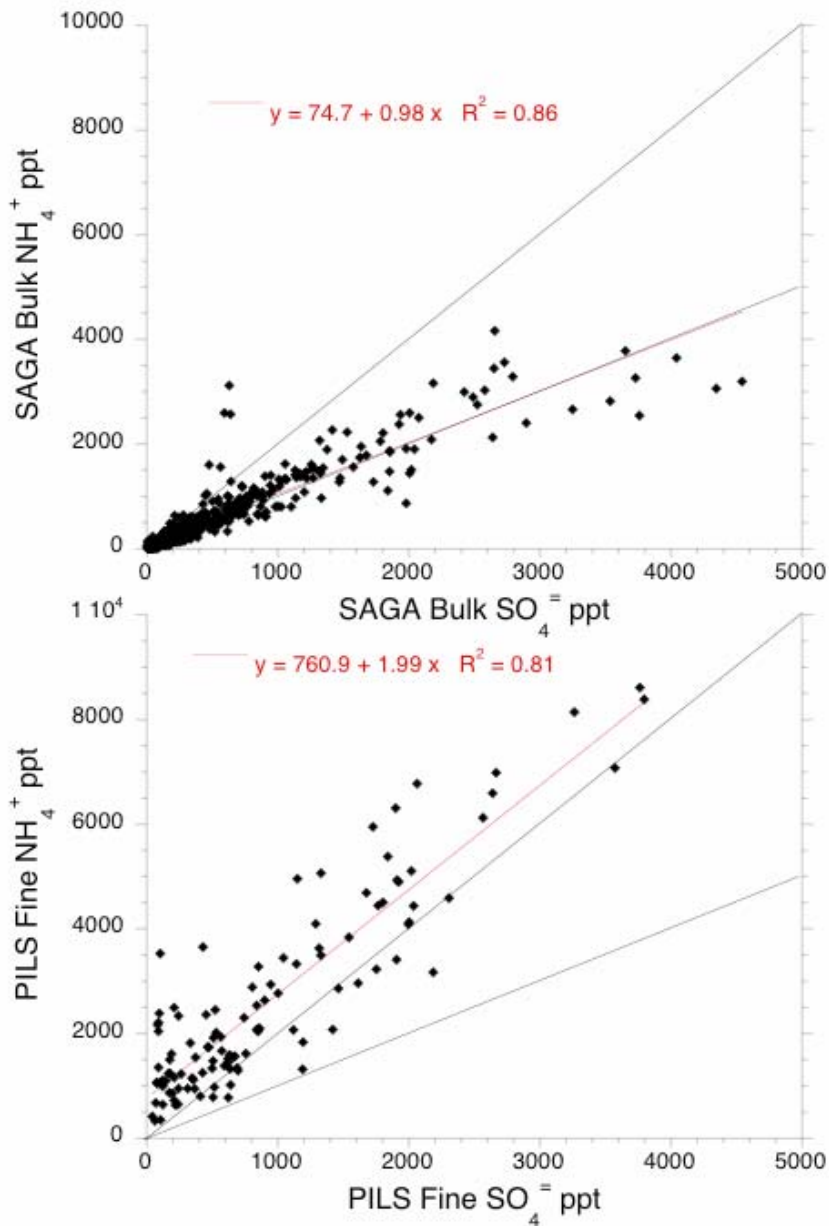
(This is very much as expected, but still good news!)



SAGA measurements of NH_4^+ were usually much less than those by PILS.

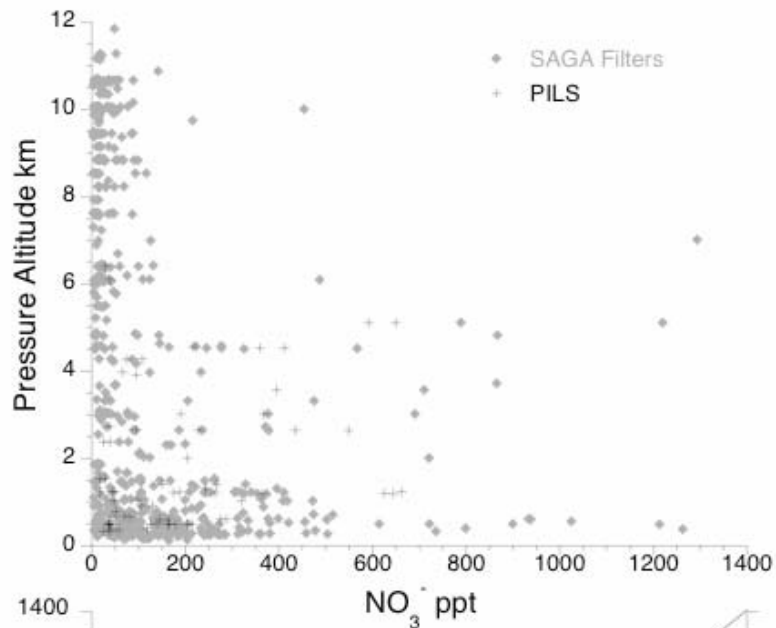
Different size cuts of the two techniques should not impact these data (most of the NH_4^+ is submicron).

Analytical, or blank, issues seem to be responsible for these differences.

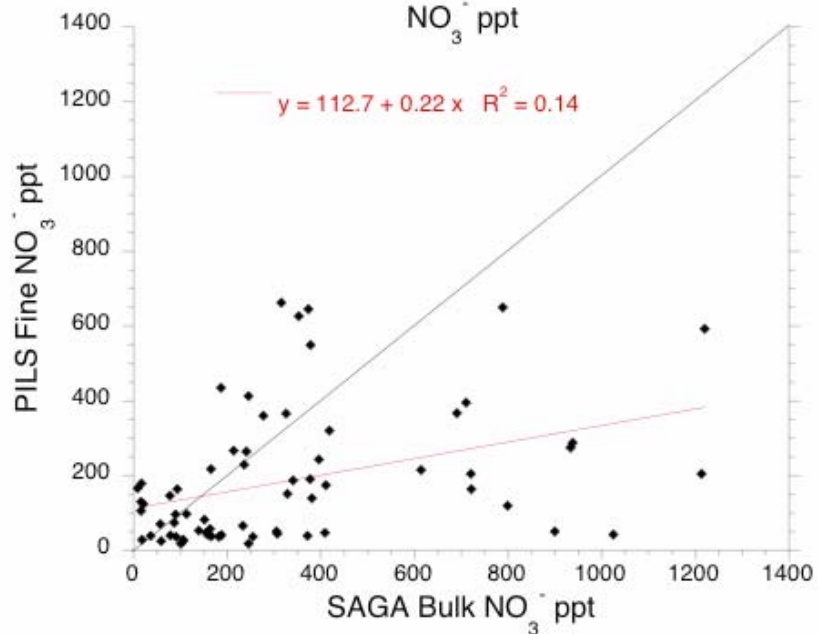


Given that SAGA SO_4^- exceeded PILS SO_4^- , while the reverse was true for NH_4^+ , large differences in $\text{NH}_4^+/\text{SO}_4^-$ should not be surprising.

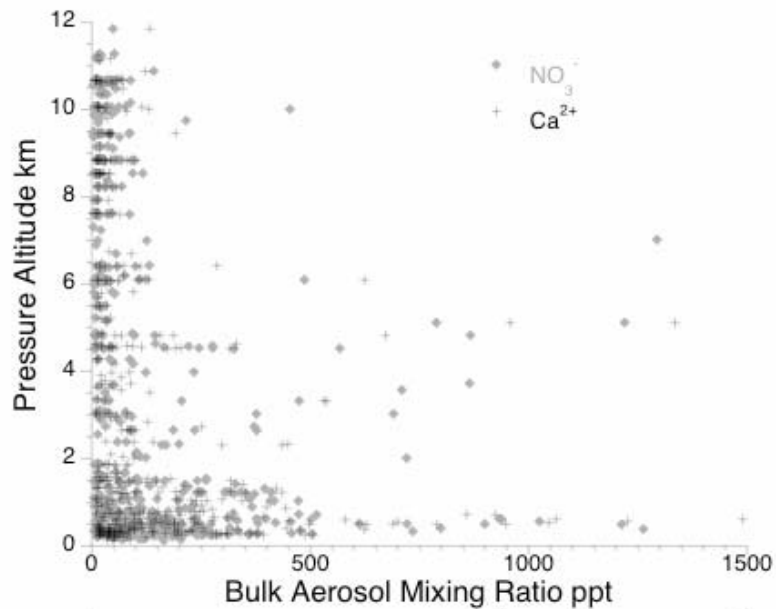
SAGA observations suggest the inorganic aerosol was dominated by NH_4HSO_4 , while PILS data suggest that NH_3 was generally abundant enough to more than fully neutralize SO_4^- .



Neither technique found aerosol NO_3^- to be all that high, except in a few plumes.

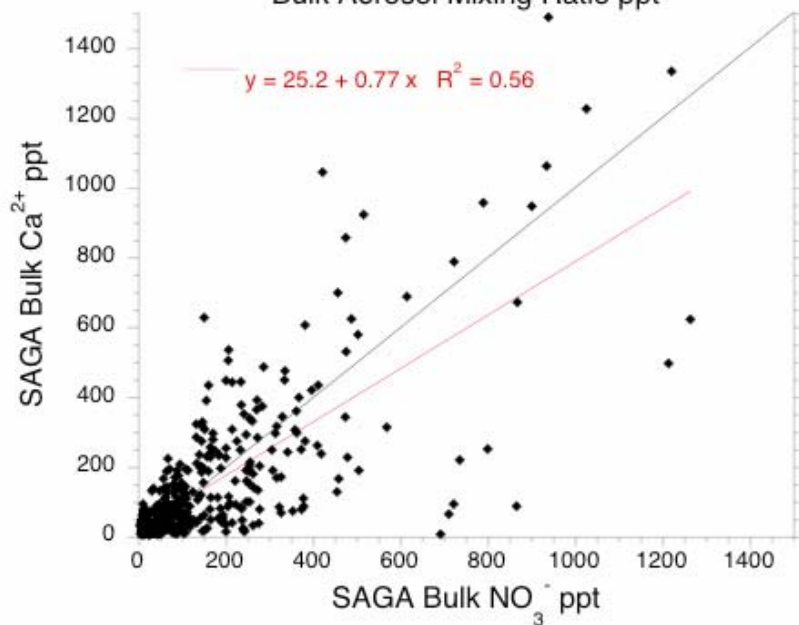


Higher NO_3^- in the SAGA bulk samples than PILS is consistent with much of it being on larger particles (e.g., not NH_4NO_3).



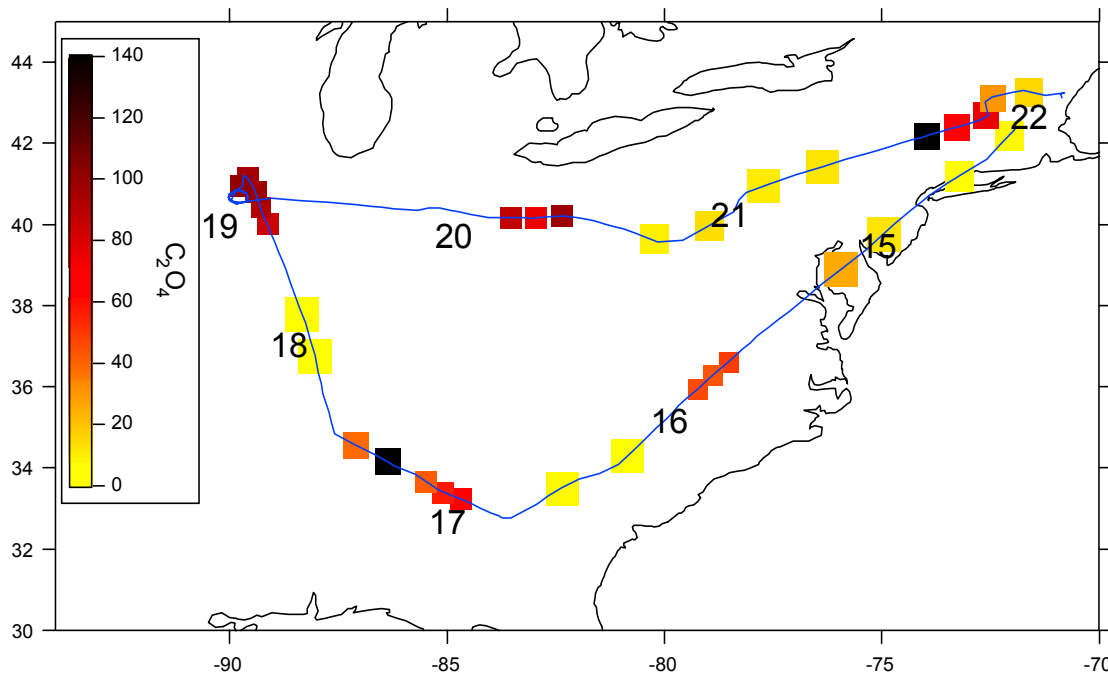
Coarse aerosol NO_3^- can result from HNO_3 reacting with dust and/or seasalt.

Highest NO_3^- mixing ratios in the filter samples often associated with elevated Ca^{2+} .

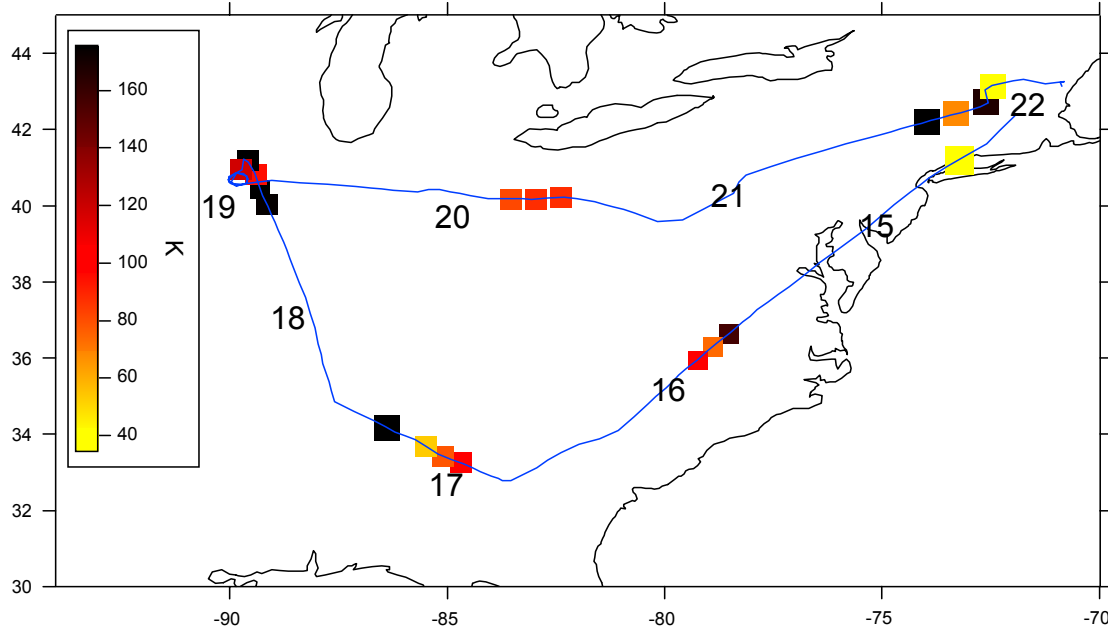


Flight 10, 20 July 2nd Pease Local

Filter sample locations along
flight track, color coded by
 C_2O_4^- mixing ratio.

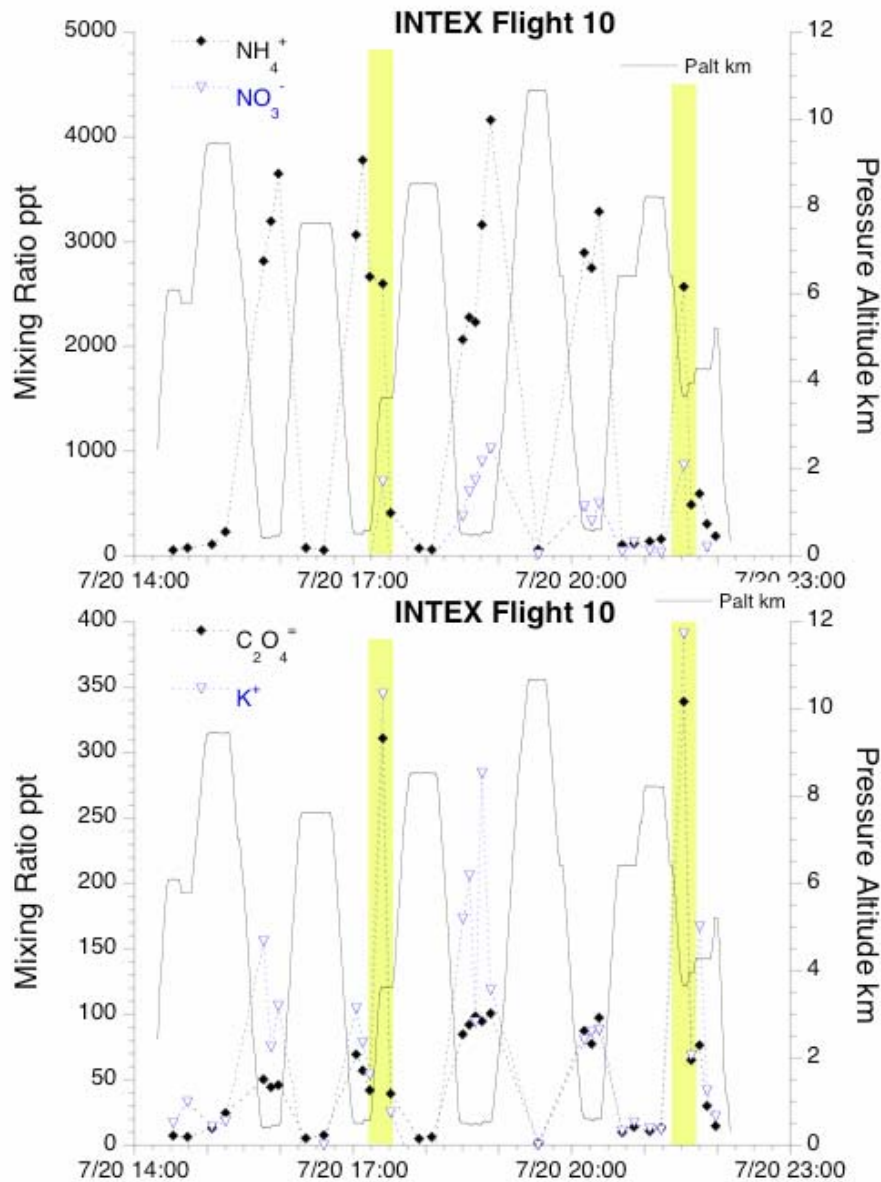


Filter sample locations along
flight track, color coded by
 K^+ mixing ratio.



Smaller symbols represent
low altitude. Numbers are
hours UTC.

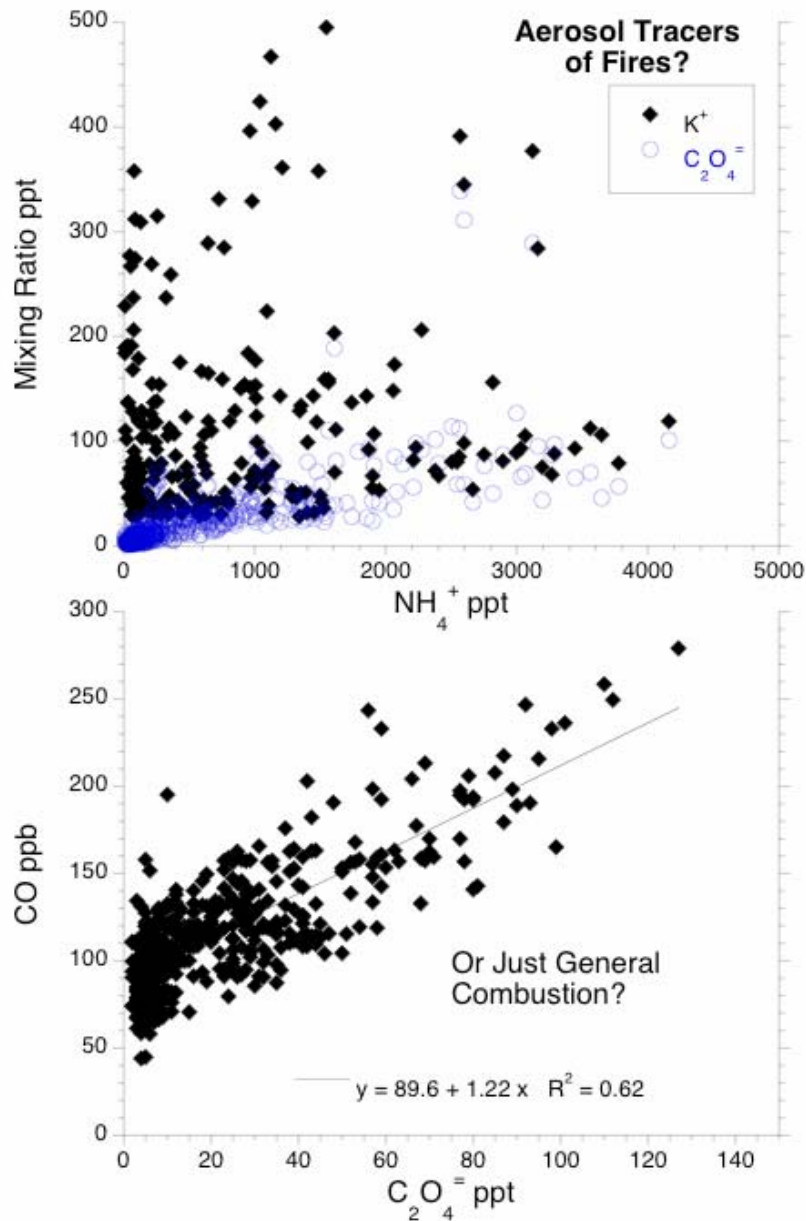
(Thanks Nicola!)



Biomass Burning

Strong enhancements in NH_4^+ , K^+ and $\text{C}_2\text{O}_4^{=}$ (and to a lesser extent NO_3^-) just above 4 km are consistent with a smoke plume.

Smaller enhancements in the BL could support the suggestion that the smoke was down there too.



It appears that there are too many other sources of NH_4^+ , K^+ , and $C_2O_4^{=}$ for any one of them to be unambiguous tracer of biomass burning.

The correlation between NH_4^+ and $C_2O_4^{=}$ hints that elevated levels of both tracers may be more specific.

However, $C_2O_4^{=}$ may be a general tracer of combustion.

Multiple tracers likely needed to identify biomass burning plumes in the INTEX data set.